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Experiences with Distal Splenorenal Shunt

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As shunt procedures for portal hypertension with gastroesophageal varices, porta-caval anastomosis and splenorenal shunt have long been widely used. Although porta-caval anastomosis is excellent for the decompression of gastro-esophageal varices, the incidence of postoperative encephalopathy is so high that social rehabilitation of the patient is often very difficult, and there is a high mortality rate. Therefore, porta-caval anastomosis is rarely used now. Splenorenal shunt also has some drawbacks: occasional obstruction, unusual direction of the flow, unsatisfactory decompression for gastro-esophageal varices and a moderately high incidence of postoperative encephalopathy. Thus, this operation has some of the same disadvantages as porta-caval anastomosis.

Warren reported distal splenorenal shunt for selective decompression of gastro-esophageal varices in 1967[3]. This operation maintains hepatic perfusion by portal venous blood and allows the blood in the gastro-esophageal varices to flow down to the inferior vena cava via the splenorenal shunt. The unacceptably high mortality of this operation in the first

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reported series and difficulty of the operative technique[3] prevented wide acceptance of this operation. A later report, however, shows decrease of mortality to an acceptable level, absence of postoperative recurrence of gastroesophageal bleeding and a lower incidence of encephalopathy[4]. The authors have been investigating this operation and present here the results of seven operations of distal splenorenal shunt and one of side-to-side anastomosis of splenic and renal veins.

Patients

From March 1972 through July 1976, seven patients were treated with distal splenorenal shunt (Warren) and one patient with side to side anastomosis between splenic and left renal veins. Portal hypertension and gastro-esophageal varices were caused by liver cirrhosis in four cases, liver fibrosis in two and Banti's syndrome in two (Table 1). The ages of the patients ranged from 16 to 51 years, averaging 38 years at the time of surgery. Five patients were male and three were female. A history of variceal hemorrhage was elicited in five patients, four with liver cirrhosis and one with Banti's syndrome. No patient had a history of encephalopathy preoperatively. Two patients had persistent ascites, controlled by large amounts of diuretics. All patients had splenomegaly. None showed hepatomegaly ; one had a very small liver as judged by percussion.

Preoperative peripheral hematologic studies showed : RBC 260 to 510×10^4/cumm, hemoglobin 7.2 to 14.4 g/dl, WBC 1,200 to 4,400/cumm and platelet count 2.5 to 8.2×10^4/cumm. Serum albumin ranged from 2.9 to 4.0 g/dl, SGOT from 10 to 116 u and SGPT from 9 to 34 u.

The rate of disappearance of indocyanine green (ICG) in serum ranged from 0.032 to 0.210 in five patients.

Preoperative berium contrast roentgenography revealed marked esophageal varices in all patients. Widely dilated portal veins and a tortuous splenic vein with collateral vessels around the upper abdominal region were seen on preoperative percutaneous splenoportograms, and preoperative celiacography revealed splenomegaly in all patients. Hepatic wedge pressure ranged from11.5 to 32.0 mmHg (Table 1).

Operative technique

Basically, surgery was performed as described by WARREN[3][4][5]. After an upper midline incision, the splenic artery was exposed at the upper portion of the pancreas and a suture was placed but not ligated. Dissection of the splenic vein was started at the cephalad portion of the transverse mesocolon and the lower edge of the middle portion of the body of the pancreas. Then the posterior surface of the pancreas was dissected. and the splenic vein was approached. Exposure of the splenic vein was performed medially to its junction with the inferior mesentric vein and laterally until a sufficient length for anastomosis. Patience and caution were required for this exposure, especially in freeing this vein from its pancreatic branches. The left renal vein was obtained at the upper portion of the

Table 1.

	Name	Age	Sex	Diagnosis	History of bleeding	History of ascites	esoph. varices		HWP mmHg		K of ICG		Serum Ammonia postop γ/dl	Follow up months	Remarks
							preop.	postop.	preop.	postop.	preop.	postop.			
1	E. Y.	48	M	Liver cirrhosis	(−)	(−)	##	+			0.081	0.055	142	12	Shunt occluded Gastric transection
2	Y. N.	50	M	Liver cirrhosis	(+)	(+)	###	##	20	14	0.210	0.114	159	15	good
3	K. H.	38	M	Liver fibrosis	(+)	(−)	##	##	23.8	14	0.155	0.064	96	16	good
4	Y. K.	38	M	Liver cirrhosis	(−)	(+)	##	+	32	18	0.032	0.033	137	18	good
5	M. Y.	44	F	Banti's syndrome	(+)	(−)	##	##	22.5	17			111	38	good
6	M. M.	23	F	Liver fibrosis	(+)	(−)	##	+	14.0	19.2	0.173	0.047	105	51	good
7	Y. S.	16	M	Liver cirrhosis	(+)	(−)	##	##	20.0	29.8		0.066	117	53	good
8	M. T.	51	F	Banti's syndrome	(−)	(−)	##	÷	11.5	16.9			117	64	good

HWP : hepatic wedge pressure

K : Disappearance rate of indocyanine green (ICG)

Postoperative data were obtained 3 to 6 months after surgery.

mesentric root. The splenic vein was divided close to its junction with the inferior mesentric vein, and the mesentric end was sutured and ligated. The distal end of the splenic vein was anastomosed with the anterior surface of the left renal vein with continuous sutures of 6-0 Ethiflex. Care must be taken not to kink, overdistend or twist the splenic vein. After completion of the shunt procedure, gastric devascularization was performed with the short gastric veins left intact. The anastomosis was reinspected and its patency confirmed. The wound was closed in layers.

Operative results and postoperative Evaluation

There were no operative deaths. Postoperative follow up periods have ranged from 12 to 64 months. In a 48-year-old man with liver cirrhosis the shunt became obstructed, and variceal bleeding recurred three days postoperatively. Splenectomy and transection of the cardiac region of the stomach with esophago-gastrectomy and pyloroplasty were performed as emergency surgery. A thrombus in the splenic vein was perceived at the time of the first operation, and a distal splenorenal shunt should have been abandoned at that moment.

Patency of the shunt was confirmed by postoperative splenography in six patients (Fig. 1). One patient failed to show patency, but a scintigram of the spleen showed a decrease in volume of this organ suggesting patency of the shunt. Postoperative hepatic wedge pressure ranged from 14 to 29.8 mmHg (Table 1).

No patient had hepatic encephalopathy or recurrence of variceal bleeding, except the

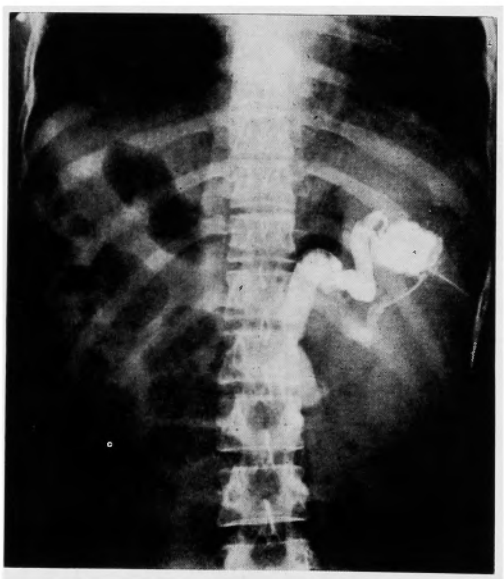

Fig. 1. Postoperative splenography shows patency of the shunt.

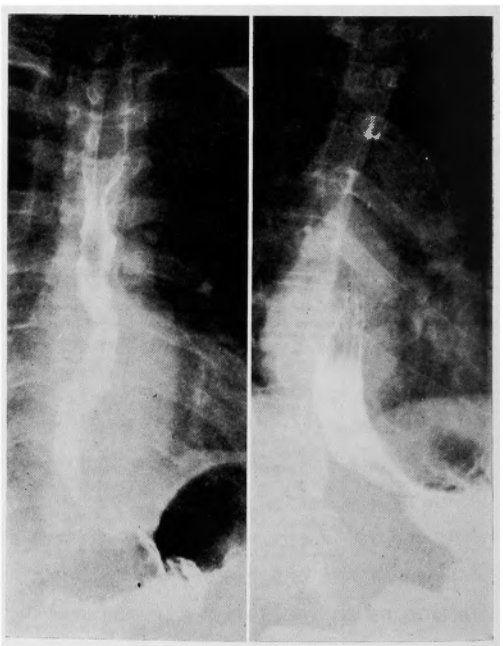

Fig. 2. Contrast roentgenography of the esophagus before (left) and after (right) distal splenorenal shunt.

one mentioned above who had re-operation. The esophageal varices decreased in all patients, but disappeared in none (Fig. 2).

The size of the spleen was evaluated by scintigrams using ^{51}Cr-labelled heat-treated red blood cells. All patients showed a decrease in volume of 9 to 38 per cent three to six months postoperatively and a continuing decrease thereafter (Figs. 3 and 4).

The postoperative disappearance rate of indocyanine green in the serum was lower than the preoperative rate in four patients and was the same low level as before operation in two patients (Table 1).

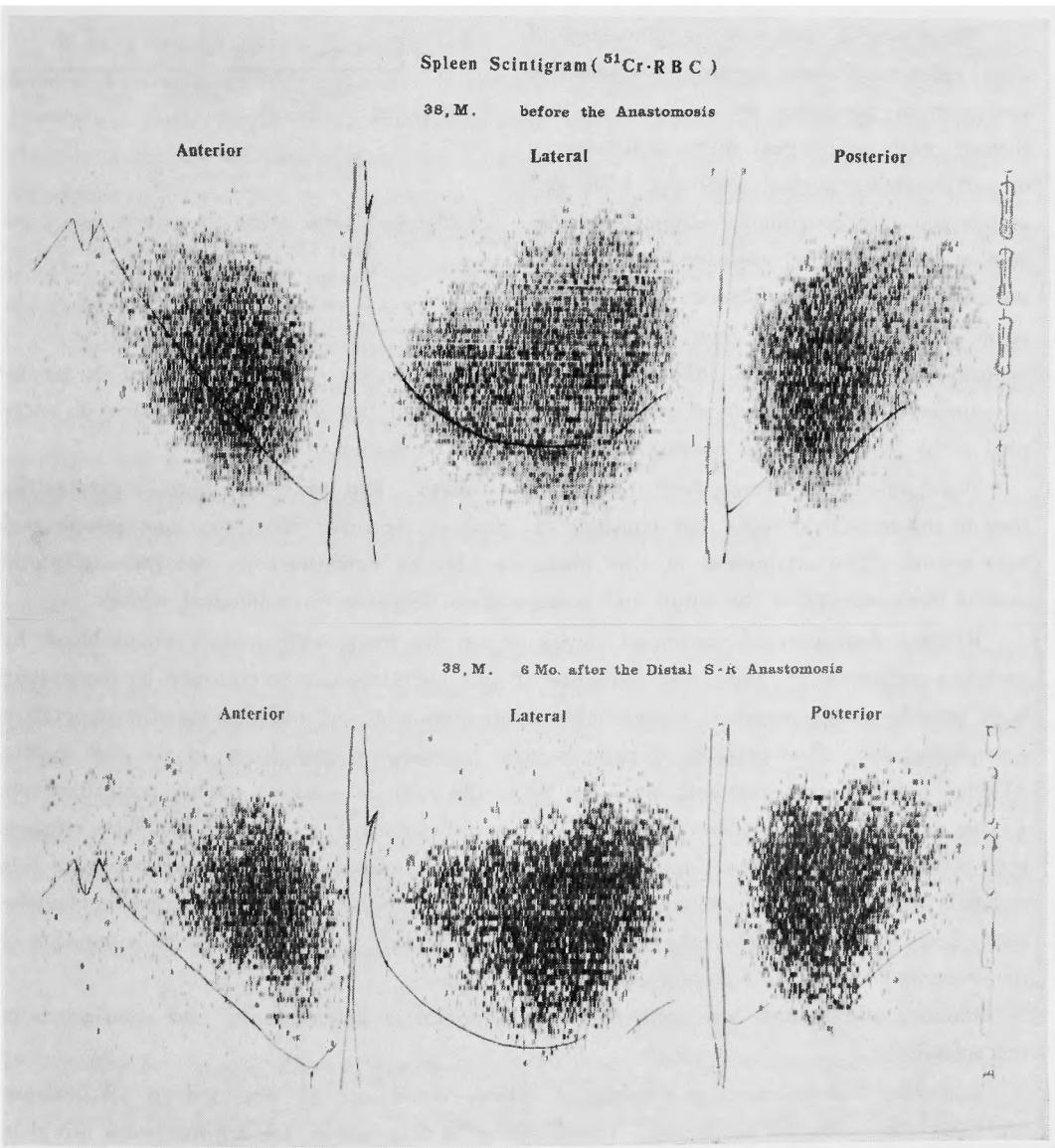

Fig. 3. Scintigram of the spleen before (upper) and after (bottom) operation.

The postoperative RBC and hemoglobin levels were within the normal range, while the WBC and platelet counts were still low. Postoperative value of SGOT and SGPT were variable, and that of cholinesterase was lower than normal. Serum albumine was around the lower limit of normal.

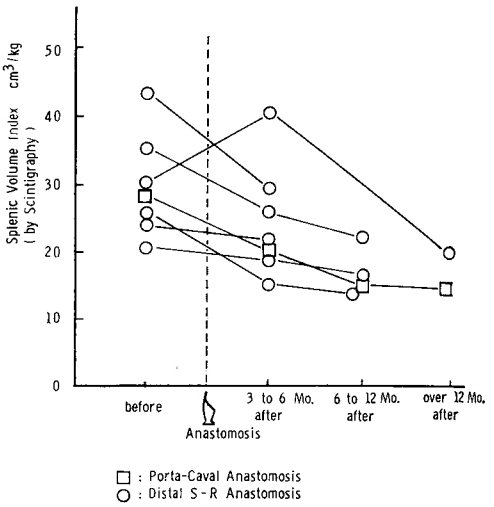

Fig. 4. Change of the spleen size before and after distal splenorenal shunt by scintigram. Patient with portacaval shunt is included for comparison.

Comment

The rationale and specific objectives of distal splenorenal shunt operation are selective reduction of pressures and volume of flow through gastroesophageal veins, maintenance of portal venous perfusion of the liver and maintenance of continued venous hypertension in the in testinal vascular bed.[3)4)5)] In ordinary portacaval anastomosis and splenorenal shunt, the greater part of the portal venous blood flows into the inferior vena cava directly or via the renal vein. This results in excellent decompression of gastroesophageal varices, but the high incidence of encephalopathy following these operations has long been a matter of concern.

Distal splenorenal shunt, first reported by WARREN[3)] and presented here, separates the flow in the mesentric veins that continue to perfuse the liver from the gastroesophageal vein system. The attainment of this objective can be confirmed by determining portal venous flow, patency of the shunt and postoperative decrease of esophageal varices.

REICHLE demonstrated continued perfusion of the liver with portal venous blood by umbilico-portograms.[1)] Indirectly, evidence of this perfusion can be obtained by moderately high hepatic wedge pressure, a reasonable serum ammonia level and absence of postoperative encephalopathy. Postoperative hepatic wedge pressure ranged from 14 to 29.8 mmHg (Table 1). The serum ammonia level was 96 to 159 γ/dl three to six month postoperatively (Table 1). So far no patients have had postoperative encephalopathy. These facts suggest that portal venous blood continues to perfuse the liver, and the detoxifying function of this organ is maintained as before operation. A very low incidence of postoperative encephalopathy has been reported by others[2)4)]. They consider this to be the result of separation of the mesentric venous and gastroesophageal vein systems.

Patency of the shunt was confirmed by postoperative splenography and scintigrams of the spleen.

Complete disappearance of esophageal varices could not be obtained in all patients, but their size definitely decreased. In regarding to this matter, the authors were afraid of insufficiency of gastric devascularization in the operative procedure. Nevertheless, there

was no postoperative variceal bleeding except in one patient, in whom obstruction of the shunt occurred. Follow up studies with scintigrams of the spleen showed continued decrease in volume, and serial barium contrast roentgenography also showed a gradual decrease in the size of esophageal varices. These findings give an optimistic outlook for the long-term results of this shunt operation.

However, the authors are concerned about the slow disappearance of ICG in the postoperative liver function tests. This is probably partly due to the decreased portal venous blood flow following diversion of splenic venous blood to the inferior vena cava. Whether this reflects real liver dysfunction caused by the shunt operation requires further evaluation.

WARREN reports that the conditions mitigating against the use of selective distal splenorenal shunt are active liver disease, the presence of ascites, thrombosis of the splenic vein, anastomical abnormalities of the splenic or renal veins and angiographic demonstration of absence of portal perfusion of the liver. Among these factors, the presence of ascites is not always a contraindication, since ascites can be controlled by strenuous medical therapy. Thrombosis of the splenic vein is an absolute contraindication. For gastric devascularization the shunt must be patent. Occlusion of the shunt is disastrous as was seen in our 48-year-old patient.

The nature of the wall of the splenic vein and the distance between the splenic and the left renal veins are important factors in this operation. In some patients the splenic vein is so fragile that it cannot be dissect. The authors had one such patient in whom operation had to be abandoned because of the frail splenic vein. It is desirable to obtain information regarding the position of the splenic and left renal veins preoperatively, because in some patients these veins are too far apart to permit anastomosis.

Summary

Distal splenorenal anastomosis was performed in seven patients with portal hypertension and esophageal varices, and side to side anastomosis between splenic and renal veins in one patient. There were no operative deaths, but in one patient the shunt was obstructed on the third postoperative day, and emergency gastric transection was performed. The patency of the shunt was confirmed in the other seven patients by splenogram and/or reduction of spleen size by scintigram. Although complete disappearance of esophageal varices could not be obtained, they definitely decreased in size. There was only one case of variceal bleeding, and no encephalopathy postoperatively. This operation is recommended as the procedure of choice for patients with portal hypertension and esophageal varices.

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和文抄録

末梢脾腎静脈吻合術の経験

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食道静脈瘤を有する門脈圧亢進症を有する7例に末梢脾腎静脈吻合術を，1例に脾腎静脈側々吻合術を施行した．対象疾患は肝硬変症4例，肝線維症2例，バンチ症候群2例で，年令は16才から51才，平均38才，男性5例，女性3例であった．手術死亡例はなく，1例に術后3日目短絡閉塞を来たして緊急胃離断術を施行した．他の7例に短絡の開存を脾静脈造影及びシンチグラムで証明した．食道静脈瘤の完全な消失は得られなかったが，その程度は明らかに減少している．先述の1例を除いて術后出血を認めた症例はなく，また術后脳障害も認めていない．本術式は食道静脈瘤を伴う門脈圧亢進症に対する短絡手術として推奨し得る．